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10/009,944	08/26/2002	Woo-Sung Han	HOLTR-400	3002

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EXAMINER

JUBA JR, JOHN

ART UNIT PAPER NUMBER

2872

DATE MAILED: 01/21/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/009,944	HAN ET AL.	
	Examiner	Art Unit	
	John Juba	2872	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 26 August 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-6, 8, 11, 13, 14, 17, 18, 20, 25, 26, 29, 30, 32, 35, and 37 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-5, 8, 11, 13, 14, 17, 18, 20, 25, 26, 29, 30, 32, 35 and 37 is/are rejected.
- 7) ☒ Claim(s) 6 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 11 December 2001 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other: _____

DETAILED ACTION***Priority***

A copy of Applicants' priority document has been received from WIPO. Acknowledgment is made of applicant's claim for priority under 35 U.S.C. 119(a)-(d) based upon an application filed in the EPO on June 11, 1999. A claim for priority cannot be based on said application, since the international application was filed more than twelve months thereafter, on June 13, 2000. Although June 11, 2000 was a Sunday, it is believed that the first business day thereafter was Monday, June 12, 2000. The examiner found no evidence of the receiving office as having been closed for business on June 12, 2000. Accordingly, Applicants have been accorded the benefit of their filing only as early as June 13, 2000.

Drawings

The drawings are objected to under 37 CFR 1.83(a) because they fail to show filter plate 55 as described in the specification (Pg. 18, line 12). Any structural detail that is essential for a proper understanding of the disclosed invention should be shown in the drawing. MPEP § 608.02(d).

The drawings are further objected to as failing to comply with 37 CFR 1.84(p)(4) because reference character "49" has been used to designate both the additional prism and the mask pattern.

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A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Specification

The disclosure is objected to because of the following informalities. Appropriate correction is required:

Page 10, line 25, "polaristion" should read "polarisation", or similarly.

Page 15, line 6, "ratating" should read "rotating".

The specification has not been checked for the presence of all possible informalities.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 18 and 30 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

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Claim 18 recites determination of the gap "interferometrically", whereas the corresponding description in the specification (Pg. 9, lines 1 – 6 and Pg. 17, lines 5 – 11) lacks any disclosure of interferometric measurement.

Claim 30 is directed to an embodiment in which the object beam intensity exceeds the reference beam intensity. However, no such embodiment is described. Only embodiments in which the reference beam is more intense are described (Pg. 6, lines 19 – 23).

Claims 25, 26, 29, 30, 32, 35, and 37 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement and as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Claims 25 and 37 recite means for directing the reference light beam at a second face of the coupling element such that it illuminates "the interface *between the first face and the ambient medium* or the interface *between a substrate in optical contact with said first face and the ambient medium* at an angle greater than the critical angle." However, the specification teaches the reference beam as being incident at the substrate-bearing face at the critical angle (Pg. 15, lines 21-25) such that it illuminates the interface between the photoresist and the ambient medium at greater than the critical angle (Pg. 13, lines 17-20), to satisfy the condition for total internal reflection at

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the interface between the photoresist and ambient medium (Pg. 9, lines 24 – 27). Insofar as the “first face” is in contact with the substrate, there appears to be no “interface between the first face and the ambient medium”, as recited. Further, insofar as the substrate is contacted with the coupling member on one side and contacted with the photoresist on the other side, there appears to be no “interface between a substrate in optical contact with the first face and the ambient medium”, as recited. That is, the disclosure lacks a written description of these features. Further, there appears to be no description that would enable construction of the apparatus being contacted in the recited manner and at the same time having the ambient interfaces recited. It is not clear if the reader was to infer that the claims are directed to illumination of the photoresist at an incident angle greater than the critical angle *defined for an* interface between the first face and the ambient medium or *an* interface between a substrate in optical contact with said first face and the ambient medium.

Claims 26, 29, 30, 32, and 35 are rejected as inheriting the same recitation through their dependency from claim 25.

Claims 3, 8, 13, 14, 17, 20, 26, 29, 32, 35, and 37 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 3, 8, 14, 20, 26, 29, 32, 35, and 37 are ambiguous and indefinite as to whether the variable is to have the value recited as being “preferable” or may have a value lying within the range more broadly recited.

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Claim 17 is confusing or incomplete as not ending in a period (.). It is not clear what limitations are to be further included. Claim 17 is further believed to be incorrect because it is the *object beam* and the *reference beam* that are scanned in the recited manner, rather than the (unsplit) illumination beam.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1 – 5 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Frosch, et al, in view of Ando, et al (U.S. Patent number 5,268,985; hereinafter, "Ando '985"). Referring *for example* to Figure 6 and the associated text, Frosch, et al disclose a method of forming a hologram from an information-containing mask (2), comprising the following steps of

arranging a substrate (5) bearing a layer of a holographic recording medium (4, H2) on a first face of a coupling element (7) and in optical contact therewith;

arranging a information containing mask (2) in a spaced relationship and parallel to the substrate (5);

generating an illumination light beam and then splitting the light beam into an object beam (0) and a reference beam (B1) (Col. 2, line 53);

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directing the reference beam (B1) to a second face of the coupling element (7) in a way that the condition for total internal reflection at the interface between the recording medium and the ambient medium is fulfilled (Col. 3, lines 59-61);

directing the object beam (0) through the mask (2) to the substrate (5) such that it overlaps with the reference beam in the holographic recording medium (4); and

arranging the planes of polarization of the object (0) and reference (B1) beams incident on the holographic recording medium such that their polarization vectors are substantially mutually orthogonal in the holographic recording medium and such that the polarization vectors of the incident (B1) and totally internally reflected (B2) reference beams are also substantially orthogonal (Col. 4, lines 1- 34).

Although Frosch, et al were identified in the International Preliminary Examination Report (PCT/IPEA/409) as disclosing a photoresist as *the holographic recording material*, the examiner finds that (without the suggestion in Applicants' disclosure) one of ordinary skill would have understood Frosch, et al as disclosing photoresist only as the photosensitive coating on the microcircuit wafer to be exposed *via the hologram*. The hologram recording material is referred to everywhere as a "photographic emulsion" or simply a "the emulsion". Thus, Frosch, et al disclose the invention substantially as claimed, but do *not* disclose a photoresist as *the holographic recording material*, as recited.

In the same field of endeavor, Ando '985 disclose a method of forming holograms by total internal reflection (TIR)(see especially Fig. 4). Ando '985 teach that the hologram recording material may be a photographic emulsion ("silver halide") or in

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some cases a photoresist (Col. 3, lines 61 – 67). That is, Ando '985 disclose the suitability of photoresists as a holographic recording medium in TIR holography, and demonstrate that the material selection is a matter of routine experimentation lying within the level of ordinary skill.

It would have been obvious to one of ordinary skill to replace the photographic emulsion of Frosch, et al with a photoresist, since the latter was recognized in the art as being suitable for use as a holographic recording material in the environment of TIR holography. It has been held that the selection of a known material based on its suitability for its intended use supports a *prima facie* finding of obviousness. *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327; 65 USPQ 297 (1945). Similarly, since the two materials recognized in the art as being equivalent recording materials in the particular environment of TIR holography, it appears that the use of photoresist in place of photographic emulsion would have been obvious. *Smith v. Hayashi*, 209 USPQ 754 (Bd. of Pat. Inter. 1980).

Applicants have attempted to establish in their disclosure (Pg. 10, lines 17 – 28) that the particular selection of a photoresist over other holographic recording materials is critical. In particular, they suggest that the photographic emulsion of Frosch, et al does not provide the rotation of polarization necessary for the invention. However, achieving polarization rotation in the reference beam upon total internal reflection is the very endeavor of Frosch, et al. Given that photoresist is taught as suitable in the environment, and given that polarization rotation is the intended result, it appears that the selection of photoresist as the recording material would not have led to any

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unexpected result. Since the amplitude and phase of light upon reflection at the interface between two materials is expected to obey the fundamental Fresnel relations, it appears that any improved results attendant the use of photoresist would hardly have been unexpected.

With regard to claim 2, Figure 6 is disclosed as producing only the transmission hologram.

With regard to claim 3, neither reference discloses the refractive index of the photoresist. However, the examiner believes that at the time of the Ando'985 disclosure, the only known photoresists had refractive indices of at least 1.6. That is, from the disclosure of Ando '985, it is believed that one of ordinary skill would at once have envisaged a refractive index greater than 1.6.

With regard to claim 4, Frosch, et al disclose that the plane of polarization of the object beam is at 45° to the plane of incidence of the reference beam at the holographic recording layer (Col. 3, lines 48-53 and Col. 4, lines 12-16).

With regard to claim 5, whatever the thickness and absorption of the photoresist, the examiner believes that the product inherently cannot exceed unity. Further, it is believed that whatever the absorption, some unit of measure for thickness can inherently be employed whereby the product is strictly less than unity, as recited.

With regard to claim 20, Frosch, et al disclose that the reference beam (B1) is directed to a second face of the coupling element in a way that the condition for total internal reflection at the interface between the recording medium and the ambient medium is fulfilled (Col. 3, lines 59-61). Since photoresists were expected to have an

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index of at least 1.6, the angle of incidence of the beam in the recording layer is would have been less than 45°.

Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Frosch, et al, in view of Ando '985, and further in view of Clube. As set forth above for claim 1, Frosch, et al and Ando '985 suggest the invention substantially as claimed. However, these references do not disclose two-dimensional scanning.

In the same field of endeavor, Clube discloses and apparatus for TIR holography. Clube teaches that it is desirable to exposed larger wafer surfaces to speed productivity. To this end, a larger holograms can be used. However, use of larger beams to record and play back the hologram gives rise to radiometric inefficiency, non-uniform illumination of the hologram, and speckle noise. In order to overcome these and other problems, Clube suggests scanning the hologram in two dimensions.

It would have been obvious to employ the scanning method of Clube in the method of Frosch, et al and Ando '985, in the interest of efficiently creating and playing back larger holograms useful for exposing larger wafers and thus improving productivity, as suggested by Clube.

Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Frosch, et al, in view of Ando '985, and further in view of Clube and Holtronic Technologies (EP 0421645 A2). As set forth above for claim 1, Frosch, et al and Ando '985 suggest the

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invention substantially as claimed. However, these references do not disclose interferometric measurement of the gap.

In the same field of endeavor, Clube discloses a method and apparatus for exposure of semiconductor wafers using TIR holograms. Clube teaches that, in order to provide an accurately focused image on the wafer, the gap separating the holographic recording material and mask must be held at an accurate separation during formation of the TIR hologram (Col. 3, lines 11 – 22). In order to do this, Clube suggests measurement of the gap using the methods Holtronic Technologies (EP 0421645 A2). Reference to the latter disclosure reveals that the method is an interferometric method.

It would have been obvious to one of ordinary skill to interferometrically measure the gap of Frosch, et al and Ando '85, in the interest of assuring accurate spacing of the holographic recording material and mask, and thus assuring accurate focusing upon reconstruction, as suggested by Clube, and Holtronic Industries.

Claims 11, 13, 25, 29, 30, 35, and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Frosch, et al, in view of Ando '85, and further in view of Lang, et al. Frosch, et al disclose the structure of the apparatus as identified above for claim 1. Ando, et al fairly suggest the use of photoresist as the holographic recording material. Further, *some* means for collimating the beam to have the desired cross section and *some* means for manipulating the incident polarization are inherent in the disclosure of Frosch, et al. Thus, Frosch, et al and Ando '85 disclose the apparatus substantially as claimed. However, these references do not particularly disclose the

structure of the collimating means and polarization manipulating means. With regard to claims 11, 13, and 30, Frosch, et al and Ando '985 do not disclose a beam ratio or means for adjusting the beam ratio.

In the same field of endeavor, Lang, et al disclose collimating means (12)(13), and polarization manipulating means (11) suitable for use in TIR holography.

It would have been obvious to one of ordinary skill to employ the collimating means of Lang, et al in the apparatus of Frosch, et al and Ando '985, since Lang, et al teach that such arrangements are well-known expedients for effecting collimation and a desired polarization state. In adapting the teachings of Lang, et al to the apparatus suggested by Frosch, et al and Ando '985, the artisan would have recognized that in order to orient the polarization planes of object and reference beams to be other than simply "S" or "P", a waveplate in each beam path would have been required to permit adjustment of the polarization state of each beam independently. That is, it is believed that in applying the teachings of Lang, et al, one of ordinary skill would have arrived at means which are functionally equivalent to those of the instant disclosure.

With particular regard to claims 11, 13, and 30, Lang, et al suggest provision of beam ratio adjustment means (8)(10) as a way of fine-tuning the recording geometry to enhance fringe contrast. Thus, it would have been obvious to provide such means in the apparatus of Frosch, et al and Ando '985, in the interest of enhance fringe contrast, and thus the radiometric efficiency of the system, as suggested by Lang, et al. Insofar as Lang, et al teaches the respective intensities of the two beams as a result-effective variable, it appears that the artisan would have arrived at relationship between beam

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intensities particularly recited through only routine experimentation and optimization of these variables.

With regard to claims 29, 35, and 37, Frosch, et al disclose that the reference beam (B1) is directed to a second face of the coupling element in a way that the condition for total internal reflection at the interface between the recording medium and the ambient medium is fulfilled (Col. 3, lines 59-61). Since photoresists were expected to have an index of at least 1.6, the angle of incidence of the beam in the recording layer is would have been less than 45°. Further, since the incident angles are recognized in the prior art as result-effective variables, it appears that one of ordinary skill would have arrived at the ranges particularly recited in claim 29 through only routine experimentation and optimization.

Allowable Subject Matter

Claim 6 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 8 and 14 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, second paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims. Subject to the rejection under 35 U.S.C. 112, first paragraph, the features additionally recited in claims 26 and 32 are drawn to allowable subject matter.

The following is a statement of reasons for the indication of allowable subject matter: The prior art, taken alone or in combination, fails to teach or to fairly suggest

the combination of method steps including selection of a photoresist such that is contrast exhibits a gamma value less than 3, as recited in claim 6;

the method or apparatus wherein laser light is used having a wavelength less than 300 nm in the combination of claim 8 or 26. Although it is common to strive for finer resolution in microcircuit patterning, and although finer resolution attends a shorter wavelength, there appears to be no suggestion in the prior art to use wavelengths shorter than 300 nm in the field of TIR holography.

Similarly, the prior art fails to teach or to fairly suggest the method or apparatus wherein a photoresist is used as the holographic recording material and the resist has a layer thickness strictly less than 500 nm in the combination of claim 14 or 32. There appears to be no recognition of photoresist thickness as a result-effective variable in the art of TIR holography.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Goto, et al disclose a method of TIR holography using photopolymers and manipulating the polarization of reference beam, reflected reference beam, and object beam so that only one hologram is formed.

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Caulfield, et al disclose readout of a total internal reflection hologram, and teach the equivalence of photographic emulsion and photoresist in this environment.

Davis, et al (GB 2,176,628 A); Ando, et al (U.S. Patent number 5,648,857) were cited in Applicants' PCT/ISA/210, completed September 27th 2000. Accordingly, copies of these references have not been enclosed.

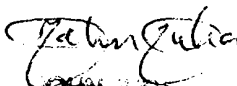
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Juba whose telephone number is (703) 308-4812. The examiner can normally be reached on Mon.-Fri. 9 - 5.

On or about January 20, 2004, the examiner's new phone number is expected to be (571) 272-2314 at the Alexandria campus.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mr. Drew Dunn can be reached on Mon.- Thu., 9 - 5.

The centralized fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306 for all communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.


JOHN JUBA
PRIMARY EXAMINER
Art Unit 2872

January 9, 2004